The

Kentucky Geological Survey

WILLARD ROUSE JILLSON
DIRECTOR AND STATE GEOLOGIST

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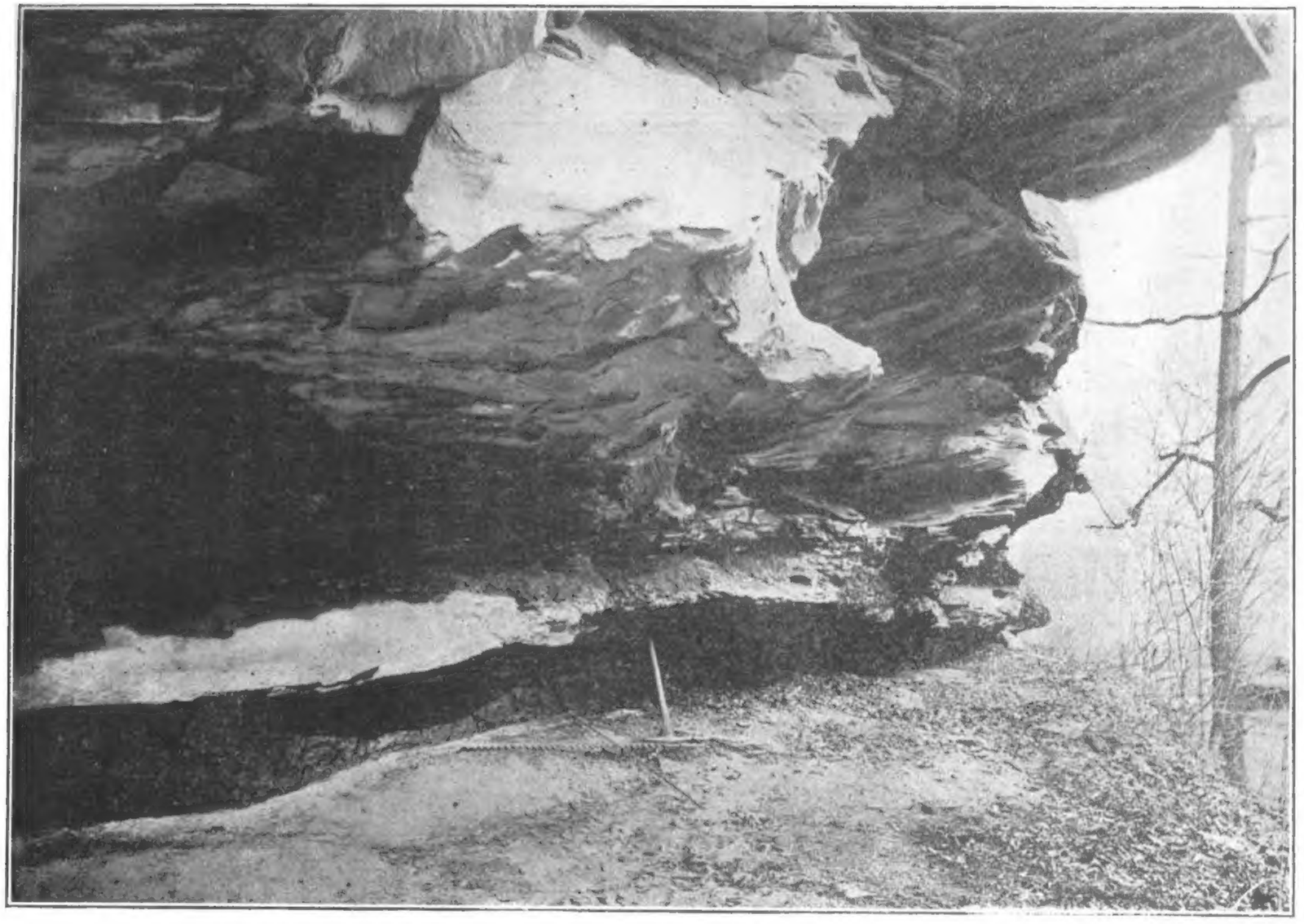

THE WHITESBURG COAL AND SANDSTONE "ROCKHOUSE" ROOF.

This characteristic view of the well known Whitesburg coal and its superimposed thirty feet of cliff forming sandstone may be seen on Otter Creek just above its juncture with the Middle Fork of the Kentucky River in Perry County.

THE
SIXTH GEOLOGICAL SURVEY

An Administrative Report of the Several Mineral Resource and General Geological Investigations Undertaken and Completed in Kentucky during the Biennial Period 1920-1921

By

WILLARD ROUSE JILLSON
DIRECTOR AND STATE GEOLOGIST

PRESENTED WITH TEN SEPARATE MISCELLANEOUS GEOLOGICAL PAPERS

BY

GEORGE P. MERRILL,
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AND
CHARLES STEVENS CROUSE

Illustrated with 101 Photographs Maps and Diagrams

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PREFACE

Applied geology is of great economic value to every State in which natural resources are only partly developed. This is especially true of Kentucky where the great body of mineral resources are now less than 20% under commercial operation. An ideal arrangement would be one where the State would have completed the base (topographic) mapping and the preliminary geological-resource surveys prior to the opening up of any oil, coal, natural gas, asphalt or other field. During the period of proving up such a field, State employed geologists could well work hand in hand with the operators, and assist them greatly in their efforts to win the resources desired.

Unfortunately this ideal arrangement has never existed in Kentucky, though it has to some extent in other States. With only 46% of Kentucky base (topographic) mapped, and with an area approximating that of sixty counties not covered by any accurate maps at all, the function of the Kentucky Geological Survey has always been crippled and held in restraint. The day of a 100% efficiency of the Kentucky Geological Survey seems yet to be in the distant future.

During the last biennium a large number of subjects of great economic value to this State have been investigated, however, by the Kentucky Geological Survey. A full account of these investigations is presented herewith in the first paper of this volume entitled, "The Sixth Geological Survey." A number of these economic papers are included within the covers of this book, and should assist materially in an understanding of the geology and resources of the several regions covered. This report is issued in an original edition of one thousand copies.

W. R. Jillson

Director and State Geologist.

Old Capitol,
Frankfort, Kentucky.
December 15, 1921.

CONTENTS

ILLUSTRATIONS

THE SIXTH
GEOLOGICAL SURVEY

X

RECENT MINERAL PRODUCTION IN KENTUCKY

By Willard Rouse Jillson.
Director and State Geologist.

THE KENTUCKY GEOLOGICAL SURVEY.

The State of Kentucky is one of the richest mineral resource storehouses of the Appalachian region. Within its area of 40,598 square miles there are found in commercial and in smaller quantities in the crude or natural state about 30 separate minerals from which a great number of mineral products may be manufactured or refined. The list of minerals and direct mineral products of Kentucky is as follows: (1) Abrasives; (2) Aragonite (Ky. Onyx); (3) Artificial Gas; (4) Asphalt Rock; (5) Barite; (6) Calcite; (7) Carbon Black; (8) Cement; (9) Clay Products (Pottery, Tile, Brick, etc.); (10) Coal (Bituminous and Cannel); (11) Coke (Beehive and By-product); (12) Copper; (13) Fluorspar; (14) Gravel; (15) Gypsum; (16) Iron; (17) Lead; (18) Lime; (19) Marble; (20) Mica: (21) Mineral Fertilizer; (22) Mineral Waters; (23) Natural Gas; (24) Ochre; (25) Oil Shale; (26) Petroleum; (27) Phosphate Rock; (28) Potash; (29) Salt; (30) Sand; (31) Silver; (32) Stone; and (33) Zinc.

Of these several minerals Copper, Gypsum, Mica and Potash occur in such a small quantity, or so rarely, as to be of no commercial importance, and therefore are of scientific interest only. A number of Kentucky's minerals, though occurring in large amounts, are not operated except in a very small way; hence the production is of little or no consequence, and will not be considered here. Included in this list are Abrasives, Aragonite (Ky. Onyx), Calcite, Iron, Marble, Ochre, Oil Shale and Salt. Of these, there is an opportunity now to develop on a much

larger scale and at a profit, Abrasives, Aragonite, Calcite, Marble and Building Stones. Kentucky iron ores, while occurring in large quantity and widely distributed, are very low grade and cannot now compete successfully with the Mesabi and Birmingham ores. Some newly discovered hematites in McCreary County may prove the exception to this rule. Kentucky (Devonian) oil shale is one of the largest and richest mineral resources of the State, though at the present low price of crude oil, and the infancy of the shale industry, the immediate development of this resource is not apprehended. The salt resources of Kentucky are not large, and rock salt in commercial quantities is unknown, but it is certain that in certain districts, notably Leitchfield, good semi-artesian brines in very large quantity may be secured.

The following minerals are operated in commercial quantity, and their production coupled with agriculture affords the principal revenue of this State. This list includes Artificial Gas, Asphalt Rock, Barite, Carbon Black, Cement, Clay (and Shale), Coal, Coke, Fluorspar, Lead, Lime, Mineral Waters, Natural Gas, Natural Gas Gasoline, Petroleum, Phosphate Rock, Sand and Gravel, Stone, Tar, and Zinc.

The three minerals having the largest production and value in the State of Kentucky for the years 1918-1920 are in order, coal, petroleum, and fluorspar. As a national producer, Kentucky was, in 1920, fifth in the production of coal, eighth in oil, and second in fluorspar in the whole United States. The production figures of these minerals with their totals is given below. These minerals aggregate in value for this short period of 3 years a total of $401,251,701.

TABLE I.

PRODUCTION OF COAL, PETROLEUM, AND FLUORSPAR IN KENTUCKY, 1918, 1919, 1920.

Coal	Production—Tons	Value	Total Number of Tons	Total Value
1918	31,530,442	$94,591,326		
1919	30,036,061	73,891,049		
1920	38,892,044	159,457,380	100,458,547	$327,939,755
Petroleum	Production—Bbls.	Value		
1918	4,306,893	$11,128,421		
1919	9,226,473	24,459,017		
1920	8,546,027	33,525,210		$69,112,648
	22,079,393 bbls.			
Fluorspar	Production—Tons	Value		
1918	87,604	$2,069,185		
1919	32,386	883,171		
1920	46,091	1,246,942	166,081	$4,199,298
Grand Totals			100,624,628	$401,251,701

The real importance and size of the coal, petroleum, and fluorspar industries in the State of Kentucky as compared to those of all other mineral industries of this State may be seen in the following table, where total values are contrasted.

The statement showing the entire mineral production of Kentucky for the three years, 1918, 1919 and 1920, insofar as it has been possible to complete it, is given herewith.

TABLE III.

1.	Artificial Gas	Production—M. Cu. Ft.	Value	Average Price
	1918	4,279,853	$202,914.00	$0.05*
	1919			
	1920			
2.	Asphalt Rock	Production—Tons	Value	Average Price
	1918	3,194	$30,343.00	$9.50
	1919	32,050	304,475.00	9,50
	1920	58,507	555,816.50	9.50
3.	Barytes	Production—Short Tons	Value	Average Price
	1918			$4.90 (?)
	1919	5,435	$36,408.00	6.70
	1920			
4.	Carbon Black (Natural Gas)	Production—Lbs.	Value	Average Price
	1918	1,600,000	$256,000.00	$0.16**
	1919	2,922,274	244,726.00	0.08-3/10
	1920	1,468,182***	308,318.22	0.21
5.	Cement	Production—Bbls.	Value	Average Price
	1918	536,491	$698,385.60	$1.60
	1919	630,000	1,077,300.00	1.71
	1920			
6.	Clay Products	Production—Brick, Tile, Pottery, Fire Clay	Value	Average Price
	1918		$6,172,554.00	
	1919			
	1920			
7.	Coal	Production—Tons	Value	Average Price
	1918	31,530,442	$94,591,326.00	$3.00
	1919	30,036,061	73,891,049.00	2.46
	1920	38,892,044	159,457,380.00	4.12
8.	Coke (Beehive & By-product)	Production—Short Tons	Value	Average Price
	1918	818,785	$4,455,995.00	$5.44+
	1919			
	1920			
9.	Fluorspar	Production—Tons	Value	Average Price
	1918	87,604	$2,069,185.00	$23.62
	1919	32,386	883,171.00	27.27
	1920	46,091	1,246,942.00	27.05

*Per M. cu. ft.
**Per pound.
***Production estimated.

10. Lead	Production—Short Tons		Value	Average Price
	1918	185	$26.270.00	$0.077
	1919	86	9,976.00	.058*
	1920	122	20,008.00	.082*
11. Lime	Production—Tons		Value	Average Price
	1918	1,884	$16,258.92	08.63
	1919	988	9.275.00	9.38
	1920	1,757	18.063.00	10.28
12. Mineral Waters	Production—Gals.		Value	Average Price
	1918	255,852	$41,997.00	$0.16
	1919	213,436	37,876.00	.17
	1920	256,959	39,600.00	.15
13. Natural Gas	Production—M. Cu. Ft.		Value	Average Price
	1918	3,022,439	$334,583.99	$0.1107**
	1919	3,942,000	390,258.00	.099
	1920	3,497,000	354,595.80	.1014
14. Natural Gas Gasoline	Production—Gals.		Value	Average Price
	1918	3.330.986	$660,108.00	$0.198
	1919	5.136.326	1.144.746.00	.223
	1920			
15. Petroleum	Production—Bbls.		Value	Average Price
	1918	4.306.893	$11,128,421.00	$2.58
	1919	9,226,473	24,459,017.00	2.65
	1920	8.546,027	33.525,210.00	3.92
16. Phosphate*** Rock	Production—Long Tons		Value	Average Price
	1918			
	1919			
	1920			
17. Sand & Gravel	Production—Tons		Value	Average Price
	1918	818,471	$557,548.00	$0.68+
	1919	1,151,297	744.073.00	.646
	1920	1,637,618	1,047,770.00	.64+
18. Stone	Production—Short Tons		Value	Average Price
	1918	988,875	$970,494.00	$0.98+
	1919	1,215,330	1,447,352.00	.653
	1920			
19. Tar	Production—Gals.		Value	Average Price
	1918	124,628	$5.995.00	$0.048
	1919			
	1920			

*Per pound.
**Per M. cu. ft.
***Data could not be secured.

20. Zinc	Production—Short Tons	Value	Average Price
1918	315	$57,330.00	$0.08*
1919	36	5,040.00	.07
1920			

While the value of the total mineral production in Kentucky at the present is probably somewhat in excess of $200,000,000 per annum as shown herein, this amount represents only about one-fifth of the amount of mineral development that this State is capable of sustaining. The exploitation of the mineral resources of Kentucky is much behind that of the adjoining States which have mineral resources of a similar value. Lack of good base maps has held back mineral development in Kentucky.

*Per pound.

PERCENTAGE OF COMMERCIAL DEPOSITS OF KENTUCKY MINERALS NOW DEVELOPED.*

Crude Minerals and Crude Mineral Products	Estimated Percentage of Deposits Now Being Operated**
1. Abrasives	5%
2. Aragonite	5%
3. Artificial gas	10%
4. Asphalt Rock	5%
5. Barite	30%
6. Calcite	20%
7. Carbon black	15%
8. Cement	10%
9. Clay products	20%
10. Coal (Bituminous and Cannel)	35%
11. Coke (Bee-hive & By-products)	25%
12. Fluorspar	75%
13. Gravel	10%
14. Lead	15%
15. Lime	5%
16. Marble	0%
17. Mineral Fertilizers	10%
18. Mineral Waters	10%
19. Natural Gas	25%

*The low grade iron ore deposits of Kentucky, widely distributed and of immense quantity, are not included in this list, since they are not at the present time able to compete commercially with the Michigan and Alabama ores.

**Exact determination of the percentage of development of the various mineral resources of Kentucky is impossible at present, due to the inadequacy of funds available for this work under State appropriation to the Kentucky Geological Survey.

20.	Ochre	2%
21.	Oil Shale	0%
22.	Petroleum	75%
23.	Phosphate Rock	25%
24.	Sand (moulding, building, glass)	3%
25.	Stone	25%
26.	Zinc	10%
	Total	470%
	Present development of all minerals, general average..	18+